CLAIMS

What is claimed is:

1. A plate heat exchanger comprising:

a plurality of plates, each plate having opposed surfaces and perimeter flanges, for providing at least one flow path for each of at least two fluids, wherein facing surfaces and perimeter flanges of a pair of adjacent plates of the plurality of plates define a flow path for each fluid of the at least two fluids, and wherein opposed surfaces of at least one plate of each pair of adjacent plates provides a flow path boundary for two fluids of the at least two fluids, the at least one plate having a high thermal conductivity and providing a portion of the flow path boundary for two fluids of the at least two fluids, thereby providing thermal communication between the two fluids on the opposed surfaces of the plate;

an inlet and outlet for each fluid of the at least two fluids, the inlet and outlet for each fluid being in fluid communication with each flow path for said fluid;

a plurality of surface microfeatures in fluid communication with at least a portion of at least one flow path for at least one fluid, the plurality of surface microfeatures for providing enhanced heat transfer between the at least two fluids, the at least one plate forming a portion of the flow path boundary.

2. The plate heat exchanger of claim 1 wherein the plurality of surface microfeatures have geometric attributes.

3. The plate heat exchanger of claim 1 wherein at least a portion of the plurality of surface microfeatures are interconnected.

4. The plate heat exchanger of claim 1 wherein the plurality of surface microfeatures correspond to openings sufficiently large to prevent entrapment of a lubricating oil.

5. The plate heat exchanger of claim 1 wherein the plurality of surface microfeatures correspond to openings from about 0.002 inches to about 0.050 inches.

6. The plate heat exchanger of claim 1 wherein at least a portion of the plurality of surface microfeatures are indented surface microfeatures.

7. The plate heat exchanger of claim 1 wherein at least a portion of the plurality of surface microfeatures are protruding surface microfeatures

8. The plate heat exchanger of claim 7 wherein at least a portion of the protruding surface microfeatures are comprised of a non-metal.

9. The plate heat exchanger of claim 1 wherein at least one insert member having at least a portion of the plurality of surface microfeatures is placed in fluid communication with at least a portion of at least one flow path for at least one fluid.

10. The plate heat exchanger of claim 9 wherein the plurality of microfeatures includes a plurality of apertures formed therein, each aperture corresponding to a nodal contact between facing surfaces of the adjacent plates of the plurality of plates.

11. The plate heat exchanger of claim 10 wherein the plate heat exchanger is of brazed construction comprising the insertion of at least one foil plate between the adjacent plates of the plurality of plates, the at least one foil plate becoming molten and flowing between adjacent plates of the plurality of plates to form brazed nodal contacts between facing surfaces of the adjacent plates of the plurality of plates when the plate heat exchanger is heated to a predetermined temperature below the melting point of the adjacent plates of the plurality of plates, but above the melting temperature of the at least one foil plate, the at least one insert member having a coating layer applied to the surfaces of the at least one insert member to substantially prevent molten metal from the foil plate from flowing into the plurality of microfeatures of the at least one insert member.

12. The plate heat exchanger of claim 10 wherein the coating layer is an oxide coating.

13. The plate heat exchanger of claim 10 wherein the coating layer is an oxide coating selected from the group consisting of nickel oxide, chromium oxide, aluminum oxide, and zirconium oxide or combinations thereof.

14. The plate heat exchanger of claim 9 wherein facing surfaces of the at least one insert member and one of the pair of adjacent plates of the plurality of plates are substantially immediately adjacent.

15. The plate heat exchanger of claim 9 wherein the at least one insert member is an insert plate.

16. The plate heat exchanger of claim 9 wherein facing surfaces of the at least one insert member and one of the pair of adjacent plates of the plurality of plates are separated by a gap.

17. The plate heat exchanger of claim 16 wherein the gap is angular.

18. The plate heat exchanger of claim 16 wherein the gap is formed by a plurality of spacers interposed between facing surfaces of the at least one insert member and one of the pair of adjacent plates of the plurality of plates.

19. The plate heat exchanger of claim 9 wherein the at least one insert member is a mesh.

20. The plate heat exchanger of claim 19 wherein the mesh is of unitary construction.

21. The plate heat exchanger of claim 20 wherein the cross sectional profile of a member of the mesh is non-circular.

22. The plate heat exchanger of claim 19 wherein the mesh includes a backing layer.

23. The plate heat exchanger of claim 22 wherein the backing layer is comprised of a metal.

24. The plate heat exchanger of claim 22 wherein the backing layer extends past opposed edges of the mesh and then folds over the opposed edges.

25. The plate heat exchanger of claim 19 wherein the at least one mesh has openings from about 0.0001 inches to about 0.050 inches.

26. The plate heat exchanger of claim 19 wherein the at least one mesh has openings from about 0.002 inches to about 0.050 inches.

27. The plate heat exchanger of claim 19 wherein the mesh is comprised of a plurality of mutually transverse interwoven members.

28. The plate heat exchanger of claim 19 wherein the cross sectional profile of a member of the mesh is non-circular.

29. The plate heat exchanger of claim 19 wherein the at least one mesh comprises a plurality of stacked mesh layers.

30. The plate heat exchanger of claim 29 wherein the plurality of stacked mesh layers is about a 400 mesh first layer and about a 100 mesh second layer.

31. The plate heat exchanger of claim 29 wherein the plurality of stacked mesh layers is about a 400 mesh first layer and about a 400 mesh second layer.

32. The plate heat exchanger of claim 29 wherein the plurality of stacked mesh layers is about a 400 mesh first layer, about a 100 mesh second layer and about a 100 mesh third layer.

33. A method for providing an enhanced heat transfer surface for use with a plate heat exchanger including a plurality of plates, each plate having opposed surfaces and perimeter flanges, for providing at least one flow path for each of at least two fluids, wherein facing surfaces and perimeter flanges of a pair of adjacent plates of the plurality of plates define a flow path for each fluid of the at least two fluids, and wherein opposed surfaces of at least one plate of the pair of adjacent plates provides a flow path boundary for two fluids of the at least two fluids, the at least one plate providing a flow path boundary having a high thermal conductivity, thereby providing thermal communication between the two fluids on the opposed surfaces of the plate, an inlet and outlet for each fluid of the at least two fluids, the inlet and outlet for each fluid being in fluid communication with each flow path for said fluid, the step comprising:

forming a plurality of surface microfeatures on at least a portion of at least one surface of at least one of the plates by deposition.

34. The method of claim 33 wherein the deposition is achieved by plasma spray, powder spray or vapor deposition.

35. The method of claim 33 wherein the deposition is achieved prior to assembly of the plate heat exchanger.

36. The method of claim 33 wherein the deposition is achieved subsequent to assembly of the plate heat exchanger.

37. The method of claim 33 wherein the plurality of surface features formed on the at least a portion of one surface of at least one of the plates is comprised of a metal.

38. The method of claim 33 wherein the plurality of surface features formed on the at least a portion of one surface of at least one of the plates is comprised of a non-metal.

39. A method for providing an enhanced heat transfer surface for use with a plate heat exchanger including a plurality of plates, each plate having opposed surfaces and perimeter flanges, for

providing at least one flow path for each of at least two fluids, wherein facing surfaces and perimeter flanges of a pair of adjacent plates of the plurality of plates define a flow path for each fluid of the at least two fluids, and wherein opposed surfaces of at least one plate of the pair of adjacent plates provides a flow path boundary for two fluids of the at least two fluids, the at least one plate providing a flow path boundary for two fluids having a high thermal conductivity, thereby providing thermal communication between the two fluids on the opposed surfaces of the plate, an inlet and outlet for each fluid of the at least two fluids, the inlet and outlet for each fluid being in fluid communication with each flow path for said fluid, the step comprising:

forming a plurality of indented surface microfeatures with a forming device that is placed in contact with at least a portion of at least one surface of at least one of the plates prior to assembly of the plate heat exchanger.

40. A method for providing an enhanced heat transfer surface for use with a plate heat exchanger including a plurality of plates, each plate having opposed surfaces and perimeter flanges, for providing at least one flow path for each of at least two fluids, wherein facing surfaces and perimeter flanges of a pair of adjacent plates of the plurality of plates define a flow path for each fluid of the at least two fluids, and wherein opposed surfaces of at least one plate of the pair of adjacent plates provides a flow path boundary for two fluids of the at least two fluids, the at least one plate providing a flow path boundary having a high thermal conductivity, thereby providing thermal communication between the two fluids on the opposed surfaces of the plate, an inlet and outlet for each fluid of the at least two fluids, the inlet and outlet for each fluid being in fluid communication with each flow path for said fluid, the step comprising:

placing at least one insert member having a plurality of surface microfeatures between at least one pair of facing surfaces of adjacent plates of the plurality of plates defining a fluid flow path.